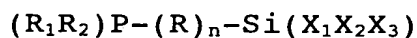


What is claimed is:

1. A method for forming an underlayer film for copper, characterized by comprising a process of bringing an underlayer film-forming material for copper including a compound represented by the following general formula [I] into contact with a surface of a substrate:

General formula [I]



wherein at least one of X_1 , X_2 , and X_3 represents a hydrolysable group; R_1 and R_2 each represent an alkyl group; R represents a divalent linear organic group which is formed of an alkylene group, an aromatic ring, or an alkylene group including an aromatic ring; and n represents an integer of 1 to 6.

2. A method for forming an underlayer film for copper according to claim 1, characterized in that the underlayer film for copper is formed such that the $(R_1R_2)P-(R)_n-Si$ group thereof bonds to the substrate via a Si-O bond, and the underlayer film for copper is formed by a reaction between -OH on the surface of the substrate and $-Si(X_1X_2X_3)$ in a liquid phase.

3. A method for forming an underlayer film for copper according to claim 1, characterized in that the underlayer film for copper is formed such that the $(R_1R_2)P-(R)_n-Si$ group thereof bonds to the substrate via a Si-O bond, and the underlayer film for copper is

formed by a reaction in a gas phase between -OH on the surface of the substrate and $-\text{Si}(\text{X}_1\text{X}_2\text{X}_3)$.

4. A method for forming an underlayer film for copper according to claim 1, characterized in that the underlayer film for copper is formed such that the $(\text{R}_1\text{R}_2)\text{P}-(\text{R})_n-\text{Si}$ group thereof bonds to the substrate via a Si-O bond, and the underlayer film for copper is formed by a reaction in a supercritical fluid between -OH on the surface of the substrate and $-\text{Si}(\text{X}_1\text{X}_2\text{X}_3)$.

5. A method for forming an underlayer film for copper according to claim 1, characterized in that the reaction between -OH on the surface of the substrate and $-\text{Si}(\text{X}_1\text{X}_2\text{X}_3)$ is carried out at a temperature of room temperature to 450°C.

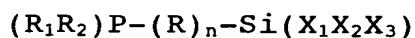
6. A method for forming an underlayer film for copper according to claim 1, characterized by further comprising a process of removing by-product(s) produced in the reaction between -OH on the surface of the substrate and $-\text{Si}(\text{X}_1\text{X}_2\text{X}_3)$.

7. An underlayer film for copper arranged on a substrate, characterized in that the film is formed such that a $(\text{R}_1\text{R}_2)\text{P}-(\text{R})_n-\text{Si}$ group bonds to a substrate via a Si-O bond, wherein R_1 and R_2 each represent an alkyl group; R represents a divalent linear organic

group formed of an alkylene group, an aromatic ring, or an alkylene group including an aromatic ring; and n represents an integer of 1 to 6.

8. An underlayer film for copper according to claim 7, characterized in that the film is formed by a method for forming an underlayer film for copper including a process of bringing an underlayer film-forming material for copper including a compound represented by the following general formula [I] into contact with a surface of a substrate:

General formula [I]



wherein at least one of X_1 , X_2 , and X_3 represents a hydrolysable group; R_1 and R_2 each represent an alkyl group; R represents a divalent linear organic group which is formed of an alkylene group, an aromatic ring, or an alkylene group including an aromatic ring; and n represents an integer of 1 to 6.

9. A semiconductor device comprising: a substrate; an underlayer film for copper arranged on the substrate; and a wiring film made up mainly of copper and arranged on the underlayer film for copper, wherein the underlayer film for copper is formed such that a $(R_1R_2)P-(R)_n-Si$ group bonds to a substrate via a Si-O bond, wherein R_1 and R_2 each represent an alkyl group; R represents a divalent

linear organic group formed of an alkylene group, an aromatic ring, or an alkylene group including an aromatic ring; and n represents an integer of 1 to 6.